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(54) **TIRE TREAD DETECTION APPARATUS AND TIRE PRESSURE DETECTOR SETTING APPARATUS WITH TIRE TREAD DETECTION FUNCTION**

(57) A tire tread detection apparatus (100) and tire pressure detector setting apparatus (300) with tire tread detection function are provided. The tire tread detection apparatus (100) includes a body casing (10), a driving unit (20), a measuring member (30), a position member (40), and a sense member (60). The driving unit (20), the measuring member (30), and the positioning member (40) are connected. The driving unit (20) is applied for driving the measuring member (30) to protrude outward from the body casing (10) for measuring the tire tread depth of the tire (200). The sense member (60) generates a measurement signal corresponding to the positioning member (40), such that the measurement signal indicates a tire tread depth value. Therefore, the tire tread depth is efficiently and accurately acquired.

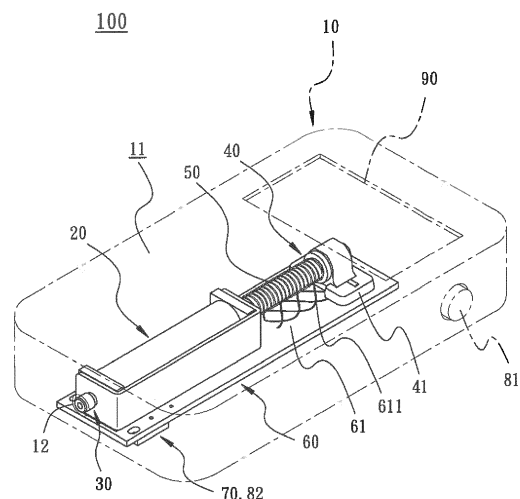


FIG. 2

Description**BACKGROUND OF THE INVENTION****1. Field of the Invention:**

[0001] The present invention relates to tire detection fields, and more particularly, to a tire pressure detector setting apparatus with tire tread detection function.

2. Description of the Related Art:

[0002] Vehicle is a commonly used transportation for movement. Besides the normal functioning mechanical parts of the vehicle, tread depth of the tire is a key element for the vehicle driving safety. The tire tread depth determines the shock absorbing and water discharging performance of a tire. When the tire tread depth becomes shallower due to the abrasion after usage, the frictional force of the tire also becomes lower, preventing the tire from efficiently gripping the road and possibly causing the vehicle to slip during a high-speed driving or emergency brake. Further, a flat tire may occur, so as to affect the vehicle driving safety. Therefore, for securing the vehicle driving safety, the tire tread depth shall be examined before the vehicle getting on the road.

[0003] The tire tread depth is able to be examined by use of a detection tool. The US patent US20140139332A1 discloses a vehicle tire inspection tool. With the head portion of the tread depth device provided with a pin, and by use of the pin end being inserted in the tire tread, the resistance variation is detected based on the variation of the strain gauge, such that the tire tread depth of the tire is acquired.

[0004] However, the bonding quality will affect the inspection accuracy. Based on the reason that the resistance value of a metal wire is applied for inspecting the variation, the strain gauge has to be stably and accurately bonded to the inspection point for achieving the most accurate inspection result. If the bonding of the strain gauge is not properly carried out, the inspection accuracy will be affected, failing to acquire an accurate tire tread depth by use of the strain gauge.

[0005] In addition, in the citation above, the pin permanently protrudes from the head portion. When the pin end is inserted in the tire tread and reaches the bottom of the tire tread, the portion of the pin will retract into the head portion, except for the portion inserted in the tire tread. Therefore, the strain gauge generates a variation amount according to the retraction of the pin into the head portion, so as to acquire a tire tread depth.

[0006] However, due to the pin permanently protruding from the head portion, the pin is easily bent or broken under an external force imposed thereon, causing the damage of the inspection tool.

SUMMARY OF THE INVENTION

[0007] For improving the issues, the present invention discloses a tire tread detection apparatus and a tire pressure detector with tire tread detection function for efficiently and accurately acquiring the tire tread depth, so as to improve the inaccuracy issue of detection and prevent possible damage.

[0008] A tire tread detection apparatus in accordance with an embodiment of the present invention for detecting a depth of a tire tread comprises:

a body casing;

a driving unit disposed in the body casing;

a measuring member disposed in the body casing and connected with the driving unit, the driving unit driving the measuring member to move, such that the measuring member protrudes out from the body casing to measure the depth of the tire tread;

a positioning member disposed in the body casing and connected with the driving unit; and

a sense member fixed in the body casing, the sense member generating a measurement signal as a tread depth value of the tire tread according to the positioning member.

[0009] With such configuration, when the measuring member of the tire tread detection apparatus is applied for measuring the tire tread depth, the driving unit drives the measuring member to protrude out from the body casing for measuring the tire tread depth. Therefore, the detection tool does not permanently protrude, thus preventing the detection tool from possible damage.

[0010] Also, when the measuring member protrudes out from the body casing for measuring the tire tread depth, a measurement signal is generated by the sense member and the positioning member that are corresponding with each other, such that the measurement signal is interpreted as the tread depth value of the tire tread. Therefore, by acquiring the tread depth value in a sensing manner, the tire tread depth is efficiently and accurately detected, thus improving the detection inaccuracy caused by the variation of the traditional strain gauge.

[0011] Also, a tire pressure detector setting apparatus with tire tread detection function, which is coupled with a tire pressure detector, comprises:

a casing;

a setting module disposed in the casing, the setting module comprising a plurality of communication protocol information, such that when the tire pressure detector is coupled with the setting module, one of the plurality of communication protocols of the setting module is written in the tire pressure detector; and a tire tread detection module disposed in the casing, the tire tread detection module comprising a driving unit, a measuring member, a positioning member,

and a sense member, the driving unit being coupled with the measuring member and the positioning member, such that the driving unit drives the measuring member to protrude out from the casing to measure a depth of a tire tread, and the measurement signal is generated by the sense member as a tread depth value of the tire tread according to the positioning member.

[0012] With such configuration, the tire pressure detector with tire tread detection function is allowed to set up the communication protocol of the tire pressure detector through the setting module. Therefore, the user is able to detect the tire tread depth by use of the tire tread detection module when installing the tire pressure detector or carrying out the tire pressure detection process.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

Fig. 1 is a schematic view illustrating the structure of the tire tread detection apparatus in accordance with an embodiment of the present invention.

Fig. 2 is a schematic perspective view of the tire tread detection apparatus in accordance with an embodiment of the present invention.

Fig. 3 is a schematic perspective view of the tire tread detection apparatus without the body casing.

Fig. 4 is an exploded view of Fig. 3.

Fig. 5 is a schematic view of the operation status of the tire tread detection apparatus, illustrating the measuring member being inserted in the tread groove of the tired tread.

Fig. 6 is a schematic view illustrating the structure of the tire pressure detector setting apparatus.

Fig. 7 is schematic perspective view of the tire pressure detector setting apparatus.

Fig. 8 is a partially exploded view of Fig. 7.

Fig. 9 is a schematic view of the tire tread detection module.

Fig. 10 is an exploded view of **Fig. 9**.

Fig. 11 is a schematic view of the operation status of the tire pressure detector setting apparatus, illustrating the measuring member inserted in the tread groove of the tire tread.

DETAILED DESCRIPTION OF THE INVENTION

[0014] The aforementioned and further advantages and features of the present invention will be understood by reference to the description of the preferred embodiment in conjunction with the accompanying drawings where the components are illustrated based on a proportion for explanation but not subject to the actual component proportion.

[0015] Referring to **Fig. 1** to **Fig. 5**, a tire tread detection apparatus **100** for detecting the tire tread depth of a tire

200 in accordance with an embodiment of the present invention comprises a body casing **10**, a driving unit **20**, a measuring member **30**, a positioning member **40**, a sense member **60**, a processing unit **70**, a power module **80**, and a display module **90**.

[0016] The driving unit **20**, the sense member **60**, the processing unit **70**, and the display module **90** are coupled with the power module **80**, such that the power module **80** supplies power to the driving unit **20**, the sense member **60**, the processing unit **70**, and the display module **90**.

[0017] Further, the driving unit **20** is connected with the measuring member **30** and the positioning member **40**. The driving unit **20** is applied for driving the measuring member **30** to move for measuring the tread depth of the tire **200**. With the movement of the measuring member, a sensing connection is established between the positioning member **40** and the sense member **60**, so as to generate a measuring signal. Then, the processing unit **70** receives the measuring signal and produces a tread depth value, which is displayed on the display module **90**.

[0018] The body casing **10** has a housing space **11** therein, and further has an opening **12** disposed at one lateral of the body casing **10**. The opening **12** is connected with the housing space **11**.

[0019] The driving unit **20** is disposed in the housing space **11** of the body casing **10**. In an embodiment of the present invention, the driving unit **20** is a solenoid valve. When the power module **80** supplies power to the driving unit **20**, the power energizes the electromagnetic coil of the driving unit **20**, such that the measuring member **30** and the positioning member **40** are driven to linearly move with respect to the body casing **10**.

[0020] The measuring member **30** is disposed in the housing space **11** of the body casing **10**. The measuring member **30** is formed in a rod shape and comprises a detection end **31** disposed in adjacent to the opening **12**. The detection end **31** is applied for being inserted in the tread groove **201** of the tire **200**. The detection end **31** has an outer diameter preferably not larger than 6mm, so as to be applied for various models of tire **200**. The driving unit **20** is allowed to drive the measuring member **30** to move between a retract position and a protrude position. When the measuring member **30** is at the retract position, the detection end **31** of the measuring member **30** is placed between the opening **12** and the housing space **11**. When the measuring member **30** moves from the retract position to the protrude position, the detection end **31** of the measuring member **30** protrudes out from the body casing **10** via the opening **12**, so as to protrude into the tread groove **201** of the tire **200** for measuring the tread depth of the tire **200**. Therein, the distance between the retract position and the protrude position is defined as the tread depth of the tire **200**.

[0021] The positioning member **40** is disposed in the housing space **11** of the body casing **10**. The positioning member **40** has a sensing portion **41** for establishing a sense connection with the sense member **60**. Therein,

the sensing portion 41 is allowed to be formed in a metal material. When the driving unit 20 drives the measuring member 30 to move, the positioning member 40 is driven to move together with the measuring member 30. In an embodiment of the present invention, the positioning member 40 has a spring 50 disposed at an outer periphery of thereof, with two ends of the spring 50 resting against the driving unit 20 and the sensing portion 41. Therein, when the driving unit 20 drives the measuring member 30 to move from the retract position to the protrude position, the spring 50 is compressed.

[0022] The sense member 60 is fixed in the housing space 11 of the body casing 10. In an embodiment of the present invention, the sense member 60 is disposed at one end of the measuring member 30 away from the detection end 31. The sense member 60 is approximately formed in a plate shape, with a sense area 61 disposed at one lateral of the sense member 60 facing the positioning member 40. The sense area 61 corresponds to a movement range of the positioning member 40. The sense area 61 has a detection pattern 611, such that the power supplied by the power module 80 is conducted to the detection pattern 611. The detection pattern 611 is formed of a magnetic or metal material. When the sensing portion 41 of the positioning member 40 covers a portion of the detection pattern 611, the measurement signal generated by the sense member 60 varies according to the covered portion of the detection pattern 611.

[0023] More specifically, when the power supplied by the power module 80 is conducted to the detection pattern 611, the portion of the detection pattern 611 of the sense area 61 covered by the sensing portion 41 formed of metal material produces a magnetic field. Therefore, the measurement signal generated by the sense member 60 is defined as the area range of the magnetic field. Also, the minimum detection unit is improved to reach a precision of 0.1mm.

[0024] The processing unit 70 is disposed in the housing space 11 of the body casing 10 and coupled with the sense member 60. The sense member 60 transmits the measurement signal to the processing unit 70. The processing unit 70 performs a calculation with the measurement signal to acquire the tread depth value. In an embodiment of the present invention, the tread depth value is a character string formed of a numerical value.

[0025] The power module 80 is disposed at the body casing 10 and comprises a switch 81 and a power unit 82. The switch 81 is applied for controlling the power unit 82 to provide the power to the driving unit 20, the sense member 60, the processing unit 70, and the display module 90. The switch 81 is disposed at an outer lateral of the body casing 10 away from the opening 12. The switch 81 is allowed to be chosen from a normal open or normal close switch, which is not limited in the embodiment of the present invention. The power unit 82 is disposed in the housing space 11 of the body casing 10. The power unit 82 is allowed to be chosen from a rechargeable form or battery form, which is not limited in the embodiment

of the present invention.

[0026] The display module 90 is disposed at the outer lateral of the body casing 10. In an embodiment of the present invention, the display module 90 is disposed at the outer lateral of the body casing 10 away from the opening 12, wherein the display module 90 and the switch 81 are disposed at the same lateral of the body casing 10.

[0027] Referring to Fig. 2, Fig. 3, and Fig. 5, when measuring the tread depth of the tire 200, the user rests one lateral of the body casing 10 of the tire tread detection apparatus 100 provided with the opening 12 against the tread face of the tire 200, and aligns the opening 12 with the tread groove 201 of the tire 200. Next, the user presses the switch 81, so that the power unit 82 supplies the power to the driving unit 20 and the driving unit 20 drives the measuring member 30 to move from the retract position to the protrude position, whereby the detection end 31 of the measuring member 30 rests against the bottom of the tread groove 201. Meanwhile, the positioning member 40 moves together with the measuring member 30 until the detection end 31 reaches the bottom of the tread groove 201, so that the sensing portion 41 covers a portion of the detection pattern 611, such that the sense member 60 generates the measurement signal according to the covered portion of the detection pattern 611, and the processing unit 70 transforms the measurement signal to a tread depth value. Then, the processing unit 70 transmits the tread depth value to the display module 90, such that the display module 90 displays the tread depth value to inform the user about the current tread depth of the tire 200.

[0028] Further, when the detection end 31 reaches the bottom of the tread groove 201, the power module 80 stops supplying the power to the electromagnetic coil of the driving unit 20. With the resilient force of the spring 50, the measuring member 30 will move from the protrude position back to the retract position, such that the detection end 31 of the measuring member 30 completely retracts into the opening 12, completing the tread depth detection of the tire 200.

[0029] Referring to Fig. 6 to Fig. 11, a tire pressure detector setting apparatus 300 with tire tread detection function is provided for being coupled with the tire pressure detector. The tire pressure detector setting apparatus 300 comprises a casing 1, a setting module 2, a tire tread detection module 3, a power module 4, and a display module 5. The setting module 2, the tire tread detection module 3, and the power module 4 are disposed inside the casing 1, and the display module 5 is disposed at an outer lateral of the casing 1. The power module 4 supplies the power to the setting module 2, the tire tread detection module 3, and the display module 5.

[0030] The casing 1 has a housing recess 101 disposed at a lateral thereof, with the housing recess 101 connected with the inside of the casing 1. The housing recess 101 houses the tire tread detection module 3, wherein the casing 1 has a cover 102 corresponding to the housing recess 101 for sealing tire tread detection

module **3** in the housing recess **101**. Therein, the cover **102** is provided with an opening **103**. Also, a connection seat **104** is disposed at an outer lateral of the casing **1**, such that the tire pressure detector (not shown) is placed at the connection seat **104**.

[0031] The setting module **2** is disposed in the casing **1** and comprises a plurality of communication protocol information. The setting module **2** is electrically connected with the tire pressure detector through the connection seat **104**, such that one of the communication protocol information is able to be written into the tire pressure detector. In other embodiments of the present invention, the casing **1** does not have the connection seat **104**, and the setting module **2** writes one of the communication protocol information into the tire pressure detector through a wireless connection.

[0032] The tire tread detection module **3** comprises a driving unit **20a**, a measuring member **30a**, a positioning member **40a**, a sense member **60a**, and a processing unit **70a**. The driving unit **20a** is connected with the measuring member **30a** and the positioning member **40a**. The driving unit **20a** drives the measuring member **30** to move for measuring the tread depth of the tire **200**. The positioning member **40a** senses the sense member **60** during the movement of the measuring member **30a**, such that a measurement signal is generated. The processing unit **70a** receives the measurement signal and produces a corresponding tread depth value.

[0033] Also, the driving unit **20a** is a solenoid valve. When the power module **80a** supplies the power to the driving unit **20a**, the power is conducted to the electromagnetic coil of the driving unit **20a**, so as to drive the measuring member **30a** and the positioning member **40a** to linearly move with respect to the casing **1**.

[0034] Referring to **Fig. 9** and **Fig. 10**, the measuring member **30a** is formed in a rod shape and comprises a detection end **31a** disposed in adjacent to the opening **103**. Therein, the detection end **31a** is applied for being inserted in the tread groove **201** of the tire **200**. The detection end **31a** has an outer diameter preferably not larger than 6mm, so as to be applied for various models of tire **200**. The driving unit **20a** is allowed to drive the measuring member **30a** to move between a retract position and a protrude position. When the measuring member **30a** is at the retract position, the detection end **31a** of the measuring member **30a** is placed between the opening **103** and the housing recess **101**. When the measuring member **30a** moves from the retract position to the protrude position, the detection end **31a** of the measuring member **30a** protrudes out from the cover **102** of the casing **1** via the opening **103**, so as to protrude into the tread groove **201** of the tire **200** for measuring the tread depth of the tire **200**. Therein, the distance between the retract position and the protrude position is defined as the tread depth of the tire **200**.

[0035] The positioning member **40a** is disposed in the casing **1**. The positioning member **40a** has a sensing portion **41a** for establishing a sense connection with the

sense member **60a**. Therein, the sensing portion **41a** is allowed to be formed in a metal material. When the driving unit **20a** drives the measuring member **30a** to move, the positioning member **40a** is driven to move together with the measuring member **30a**. In an embodiment of the present invention, the positioning member **40a** has a spring **50a** disposed at an outer periphery of thereof, with two ends of the spring **50a** resting against the driving unit **20a** and the sensing portion **41a**. Therein, when the driving unit **20a** drives the measuring member **30a** to move from the retract position to the protrude position, the spring **50a** is compressed.

[0036] The sense member **60a** is fixed in the casing **1**. The sense member **60a** is approximately formed in a plate shape, with a sense area **61a** disposed at one lateral of the sense member **60a** facing the positioning member **40a**. The sense area **61a** corresponds to a movement range of the positioning member **40a**. The sense area **61a** has a detection pattern **611a**, such that the power supplied by the power module **80a** is conducted to the detection pattern **611a**. The detection pattern **611a** is formed of a magnetic or metal material. When the sensing portion **41a** of the positioning member **40a** covers a portion of the detection pattern **611a**, the measurement signal generated by the sense member **60a** varies according to the covered portion of the detection pattern **611a**.

[0037] More specifically, when the power supplied by the power module **80a** is conducted to the detection pattern **611a**, the portion of the detection pattern **611a** of the sense area **61a** covered by the sensing portion **41a** formed of metal material produces a magnetic field. Therefore, the measurement signal generated by the sense member **60a** is defined as the area range of the magnetic field. Also, the minimum detection precision unit is improved to approximate 0.1mm.

[0038] The processing unit **70a** is disposed in the casing **1** and coupled with the sense member **60a**. The sense member **60a** transmits the measurement signal to the processing unit **70a**. The processing unit **70a** performs a calculation with the measurement signal to acquire the tread depth value. In an embodiment of the present invention, the tread depth value is a character string formed of a numerical value.

[0039] The power module **4** is disposed at the body casing **10a** and comprises a switch **401** and a power unit **402**. The switch **401** is applied for controlling the power unit **402** to provide the power to the driving unit **20a**, the sense member **60a**, the processing unit **70a**, and the display module **90a**. The switch **401** is disposed at an outer lateral of the casing **1** away from the opening **103**. The switch **401** is allowed to be chosen from a normal open or normal close switch, which is not limited in the embodiment of the present invention. The power unit **402** is disposed in the casing **1**. The power unit **402** is allowed to be chosen from a rechargeable form or battery form, which is not limited in the embodiment of the present invention.

[0040] The display module **5** is disposed at the outer lateral of the casing **1**. In an embodiment of the present invention, the display module **5** is disposed at the outer lateral of the casing **1** away from the opening **103**, wherein the display module **5** and the switch **401** are disposed at the same lateral of the casing **1**.

[0041] Referring to **Fig. 7**, **Fig. 10**, and **Fig. 11**, when measuring the tread depth of the tire **200**, the user rests the cover **102** of the tire pressure detector setting apparatus **300** against the tread face of the tire **200**, and aligns the opening **103** with the tread groove **201** of the tire **200**. Next, the user presses the switch **401**, so that the power unit **402** supplies the power to the driving unit **20a**, and the driving unit **20a** drives the measuring member **30a** to move from the retract position to the protrude position, whereby the detection end **31a** of the measuring member **30a** rests against the bottom of the tread groove **201**. Meanwhile, the positioning member **40a** moves together with the measuring member **30a** until the detection end **31a** reaches the bottom of the tread groove **201**, so that the sensing portion **41a** covers a portion of the detection pattern **611a**, such that the sense member **60a** generates the measurement signal according to the covered portion of the detection pattern **611a**, and the processing unit **70a** transforms the measurement signal to a tread depth value. Then, the processing unit **70a** transmits the tread depth value to the display module **5**, such that the display module **5** displays the tread depth value to inform the user about the current tread depth of the tire **200**.

[0042] Further, when the detection end **31a** reaches the bottom of the tread groove **201**, the power stops to be supplied to the electromagnetic coil of the driving unit **20a**. With the resilient force of the spring **50a**, the measuring member **30a** will move from the protrude position back to the retract position, such that the detection end **31a** of the measuring member **30a** completely retracts into the opening **103**, completing the tread depth detection of the tire **200**.

[0043] With the foregoing configuration, the present invention achieves following effects.

[0044] The measuring member **30** of the tire tread detection apparatus **100** is normally placed at the retract position, such that the detection end **31** of the measuring member **30** is prevented from being exposed from the body casing **10**, preventing possible damage of the measuring member **30** from happening and increasing the service life of the tire tread detection apparatus **100**.

[0045] The driving unit **20** is a solenoid valve. Upon activating the driving unit **20**, the measuring member **30** protrudes to the tread groove **201** of the tire **200** with a high speed. After the detection end **31** reaching the bottom of the tread groove **201**, the power stops to be supplied to the driving unit **20**. Then, with the resilient force of the spring **50**, the measuring member **30** fast retracts into the body casing **10**. Therefore, an easy and efficient tire tread depth detection is achieved.

[0046] By establishing the sensing connection between the positioning member **40** and the sense member

60, the tread depth value is efficiently and accurately acquired, thus solving the inaccuracy issue of the traditional strain gauge applying tread depth inspection method.

[0047] The tire pressure detector setting apparatus **300** provided by the present invention is allowed to achieve an identical function with the aforementioned tire tread detection apparatus **100**. The tire pressure detector setting apparatus **300** is able to write the communication protocol into the tire pressure detector via the setting module **2**, and also allows the user to carry out the tire tread depth detection process by use of the tire tread detection module **3** when installing the tire pressure detector or detecting the pressure of the tire **200**.

[0048] Although particular embodiments of the invention have been described in detail for purposes of illustration, various modifications and enhancements may be made without departing from the spirit and scope of the invention. Accordingly, the invention is not to be limited except as by the appended claims.

Claims

1. A tire tread detection apparatus (100) for detecting a tread depth of a tire (200), comprising:
 - a body casing (10);
 - a driving unit (20) disposed in the body casing (10);
 - a measuring member (30) disposed in the body casing (10) and connected with the driving unit (20), the driving unit (20) driving the measuring member (30) to move, such that the measuring member (30) protrudes out from the body casing (10) to measure the tread depth of the tire (200);
 - a positioning member (40) disposed in the body casing (10) and connected with the driving unit (20); and
 - a sense member (60) fixed in the body casing (10), the sense member (60) generating a measurement signal as a tread depth value according to the positioning member (40).
2. The tire tread detection apparatus (100) of claim 1, wherein the sense member (60) has a sense area (61) corresponding to a movement range of the positioning member (40), the measurement signal generated by the sense member (60) varying according to a movement of the positioning member (40) with respect to the sense area (61).
3. The tire tread detection apparatus (100) of claim 2, wherein the sense area (61) is disposed at one lateral of the sense member (60) facing the positioning member (40), the sense area (61) comprising a detection pattern (611), the positioning member (40) covering a portion of the detection pattern (611), the measurement signal generated by the sense mem-

ber (60) varying according to a variation of the covered portion of the detection pattern (611).

- 4. The tire tread detection apparatus (100) of claim 3, further comprising a power module (80) disposed in the body casing (10), the power module (80) supplying a power to the driving unit (20) and the detection pattern (611), and the positioning member (40) being formed of a metal material.
- 5. The tire tread detection apparatus (100) of claim 1, wherein the driving unit (20) drives the measuring member (30) to move between a retract position and a protrude position, and a movement distance between the retract position and the protrude position is defined as the tread depth of the tire (200).
- 6. The tire tread detection apparatus (100) of claim 1, wherein the driving unit (20) is a solenoid valve.
- 7. A tire pressure detector setting apparatus (300) with tire tread detection function, which is coupled with a tire pressure detector, the tire pressure detector setting apparatus (300) comprising:

- a casing (1);
- a setting module (2) disposed in the casing (1), the setting module (2) comprising a plurality of communication protocol information, such that when the tire pressure detector is coupled with the setting module (2), one of the plurality of communication protocol of the setting module (2) is written into the tire pressure detector; and
- a tire tread detection module (3) disposed in the casing (1), the tire tread detection module (3) comprising a driving unit (20a), a measuring member (30a), a positioning member (40a), and a sense member (60a), the driving unit (20a) being coupled with the measuring member (30a) and the positioning member (40a), such that the driving unit (20a) drives the measuring member (30a) to protrude out from the casing (1) to measure a tread depth of a tire (200), and a measurement signal is generated by the sense member (60a) as a tread depth value according to the positioning member (40a).

- 8. The tire pressure detector setting apparatus (300) of claim 7, wherein the sense member (60a) has a sense area (61a) corresponding to a movement range of the positioning member (40a), the measurement signal generated by the sense member (60a) varying according to a movement of the positioning member (40a) with respect to the sense area (61a).
- 9. The tire pressure detector setting apparatus (300) of claim 8, wherein the sense area (61a) is disposed

at one lateral of the sense member (60a) facing the positioning member (40a), the sense area (61a) comprising a detection pattern (611a), the positioning member (40a) covering a portion of the detection pattern (611a), the measurement signal generated by the sense member (60a) varying according to a variation of the covered portion of the detection pattern (611a).

- 10. The tire pressure detector setting apparatus (300) of claim 7, further comprising a power module (4) disposed in the casing (1), the power module (4) supplying a power to the driving unit (20a) and the detection pattern (611a), and the positioning member (40a) being formed of a metal material.
- 11. The tire pressure detector setting apparatus (300) of claim 7, wherein the driving unit (20a) drives the measuring member (30a) to move between a retract position and a protrude position, and a movement distance between the retract position and the protrude position is defined as the tread depth of the tire (200).
- 12. The tire pressure detector setting apparatus (300) of claim 7, wherein the driving unit (20a) is a solenoid valve.

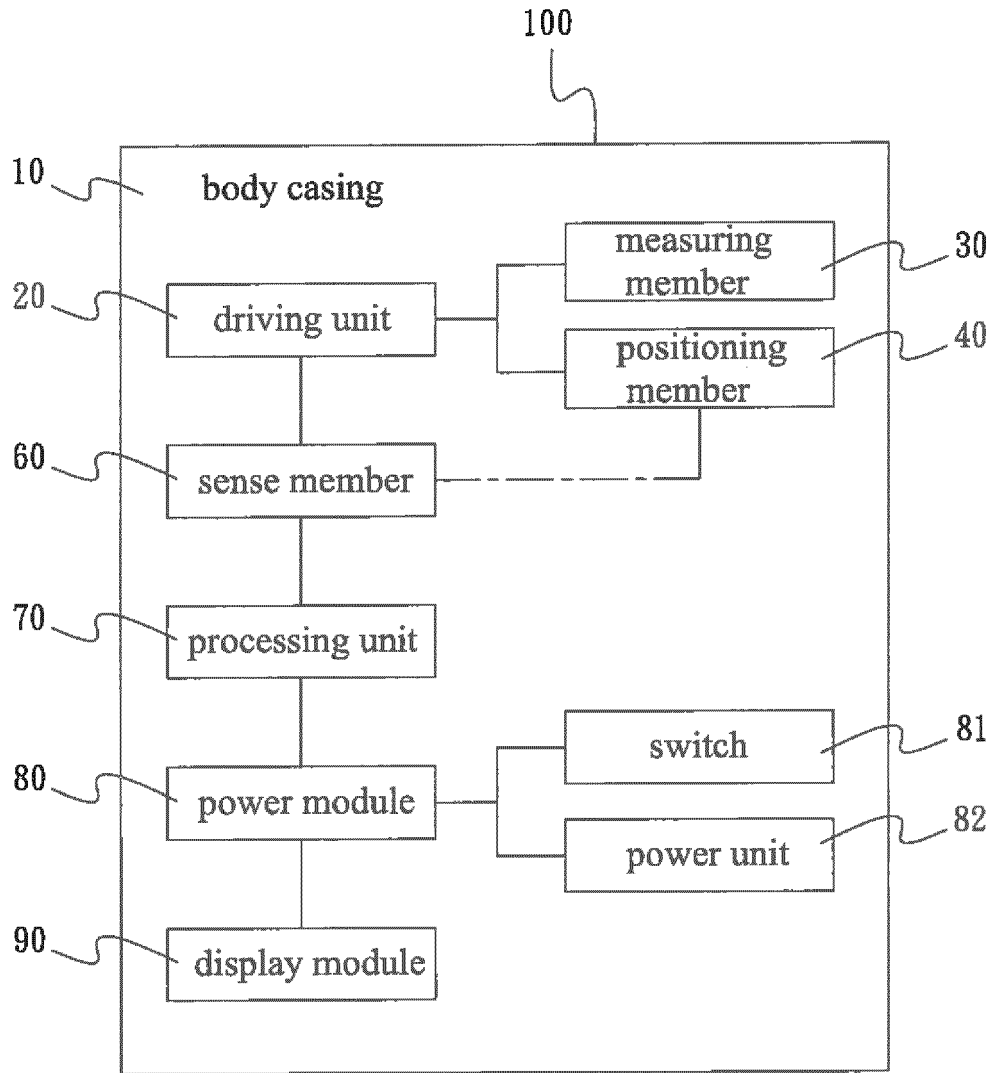


FIG. 1

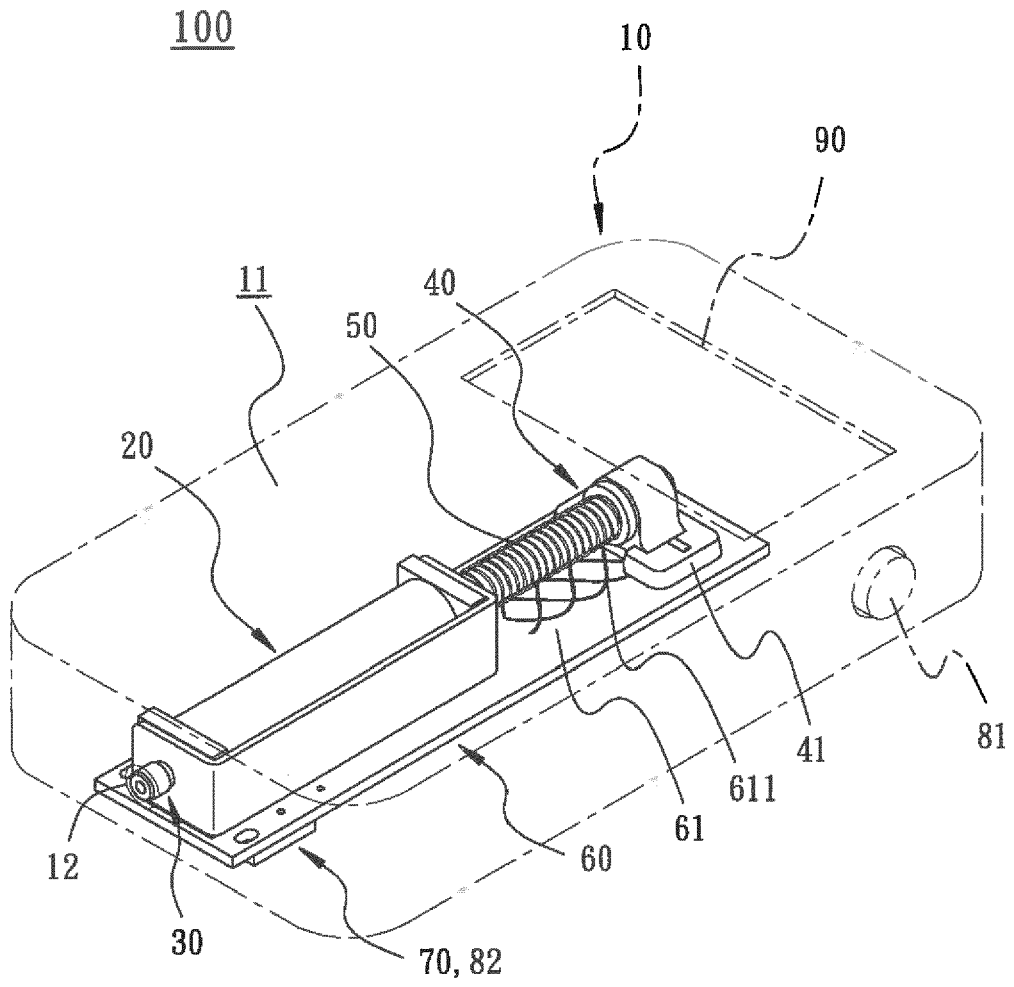


FIG. 2

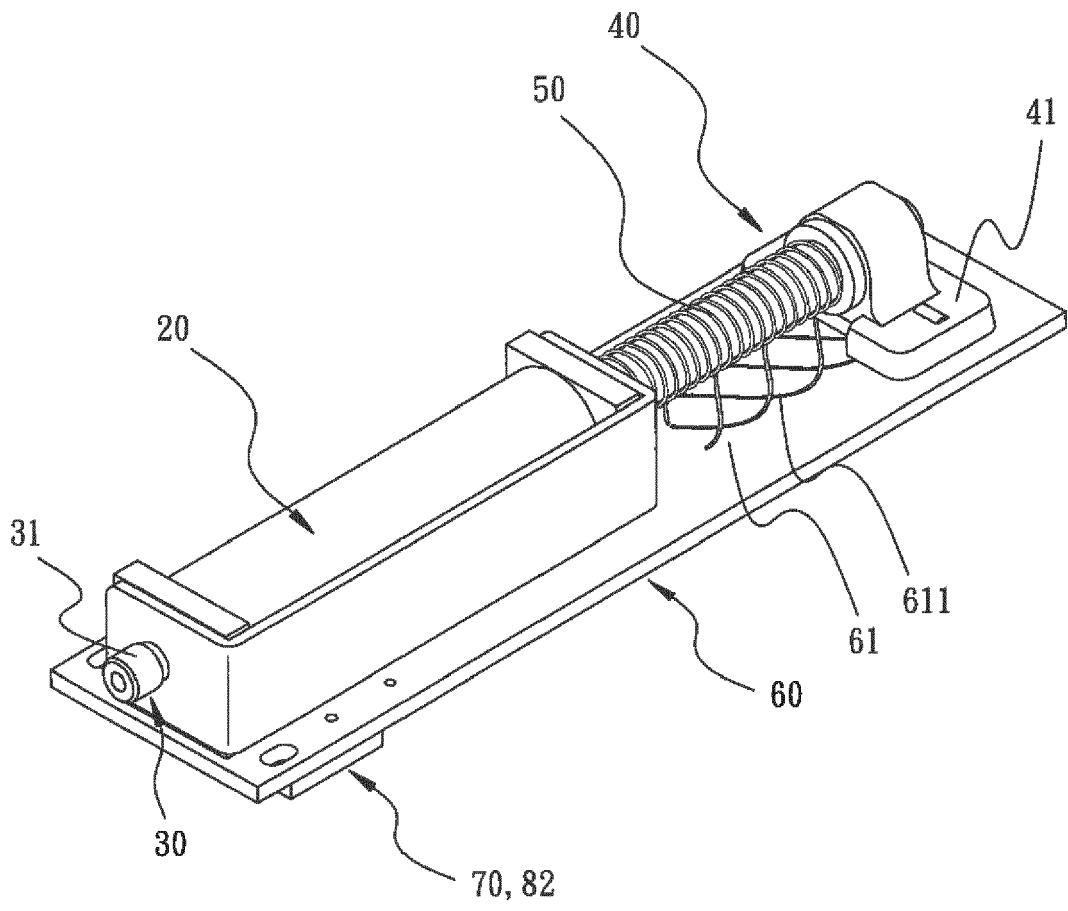


FIG. 3

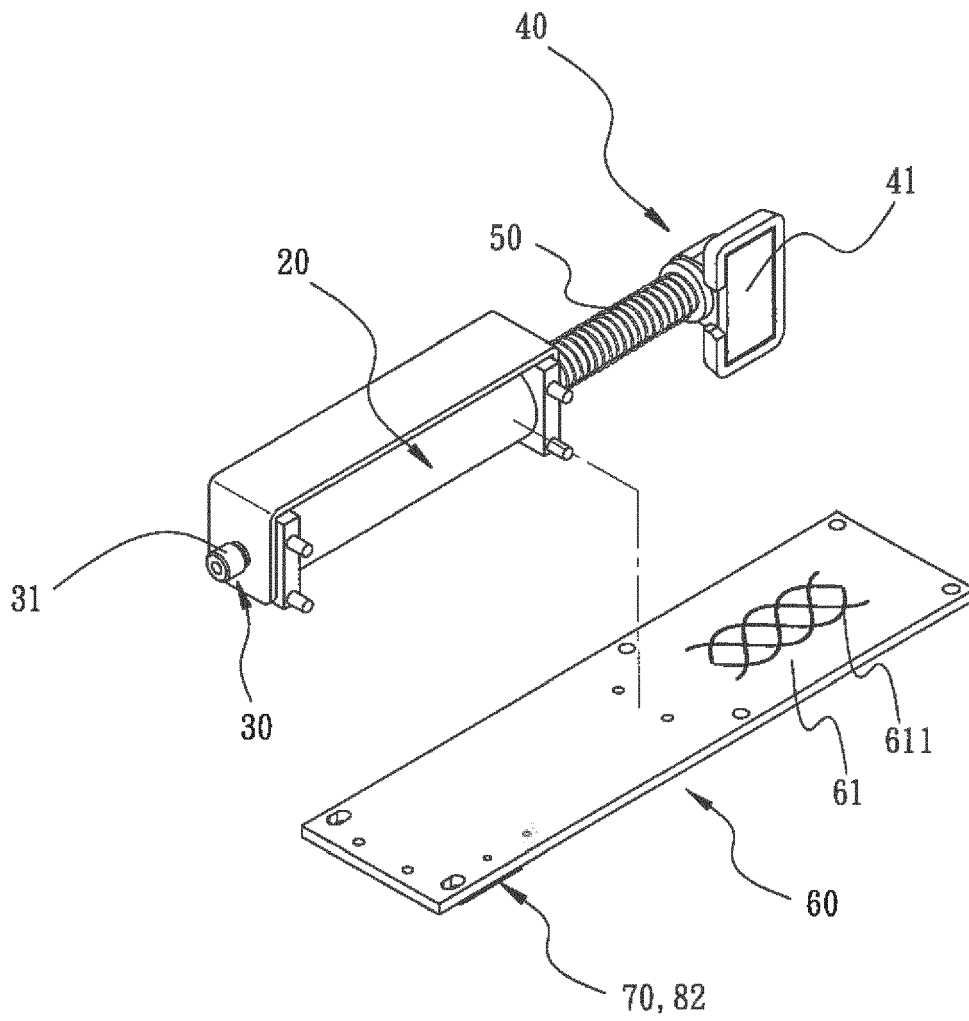


FIG. 4

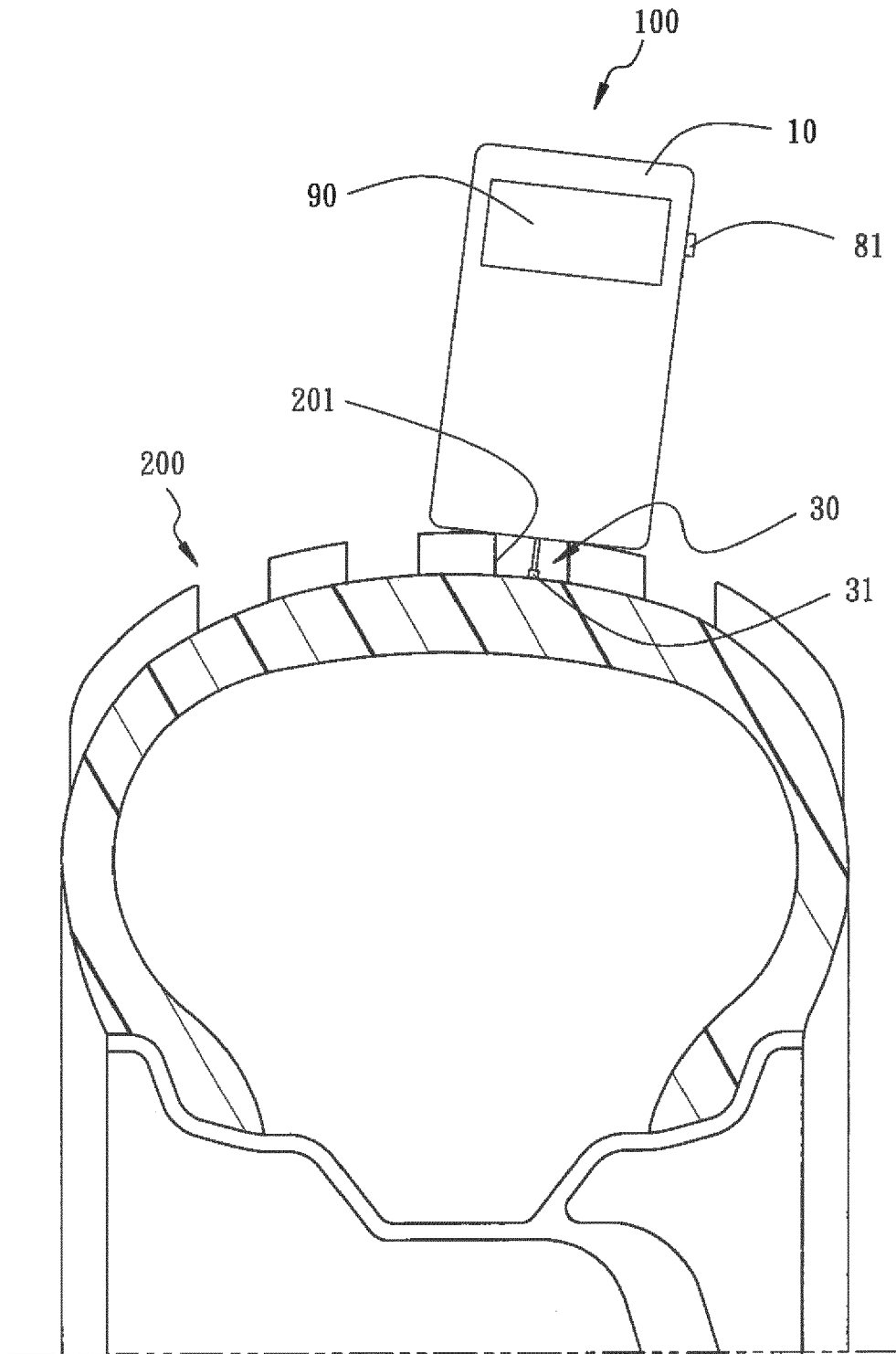


FIG. 5

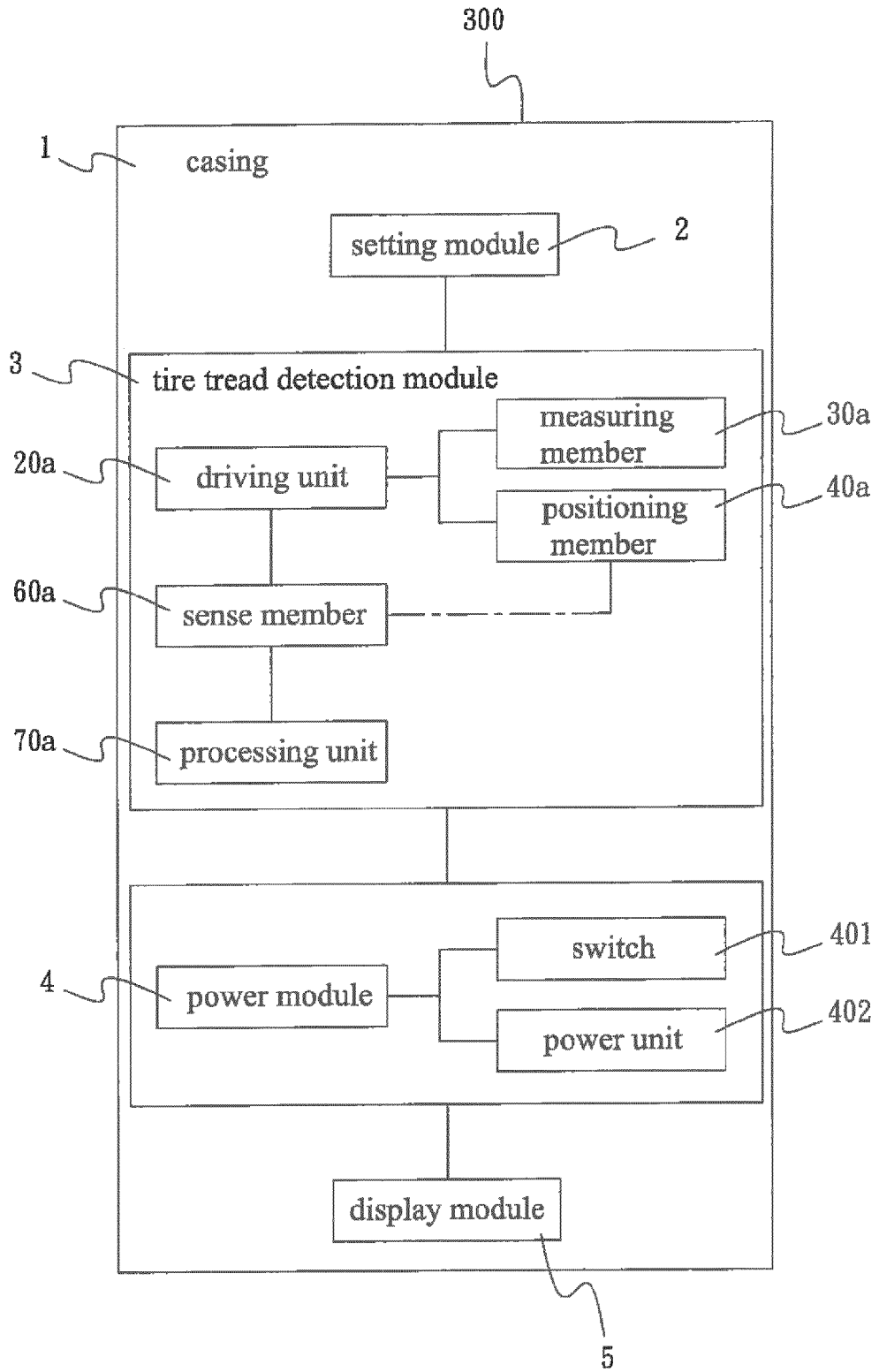


FIG. 6

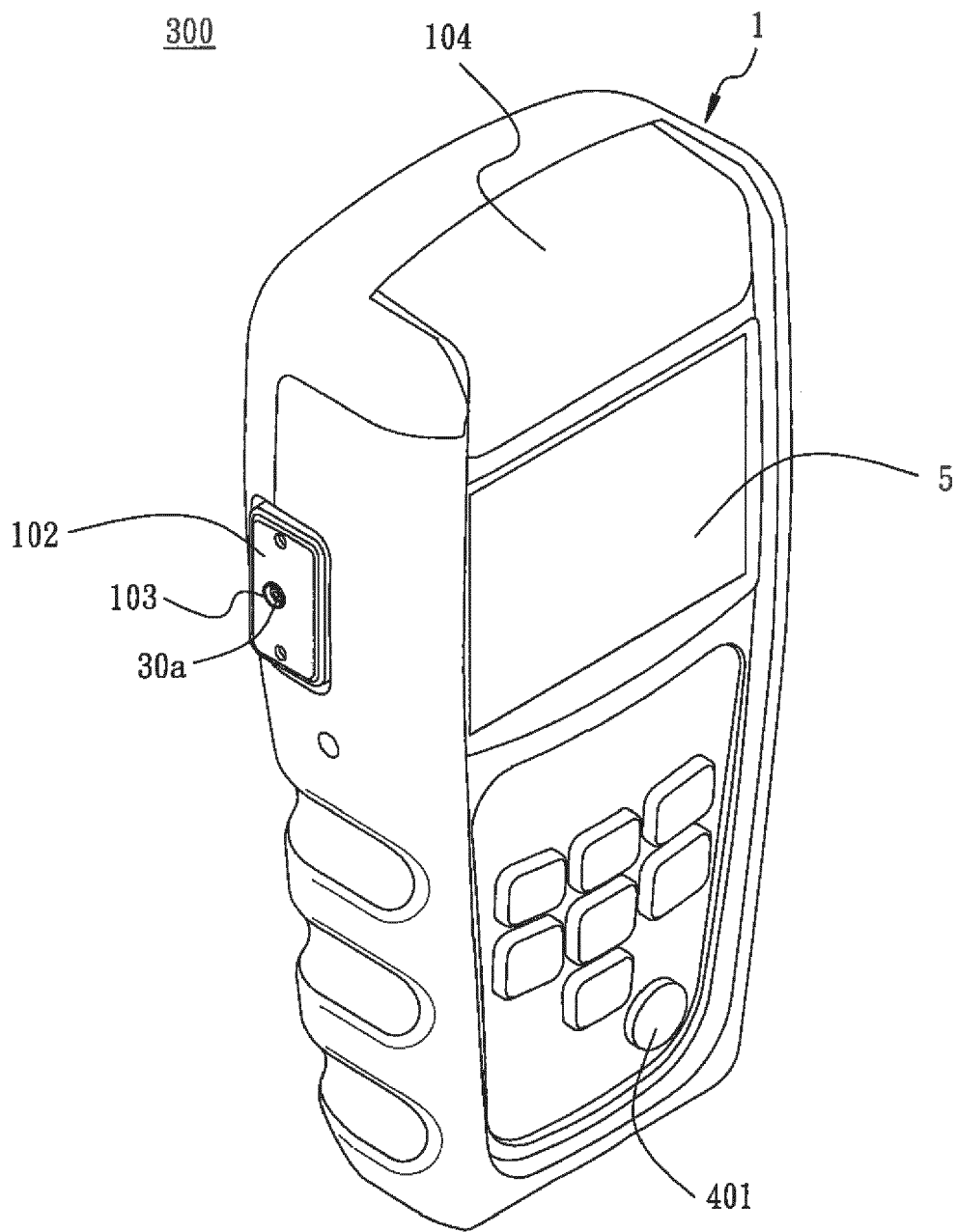


FIG. 7

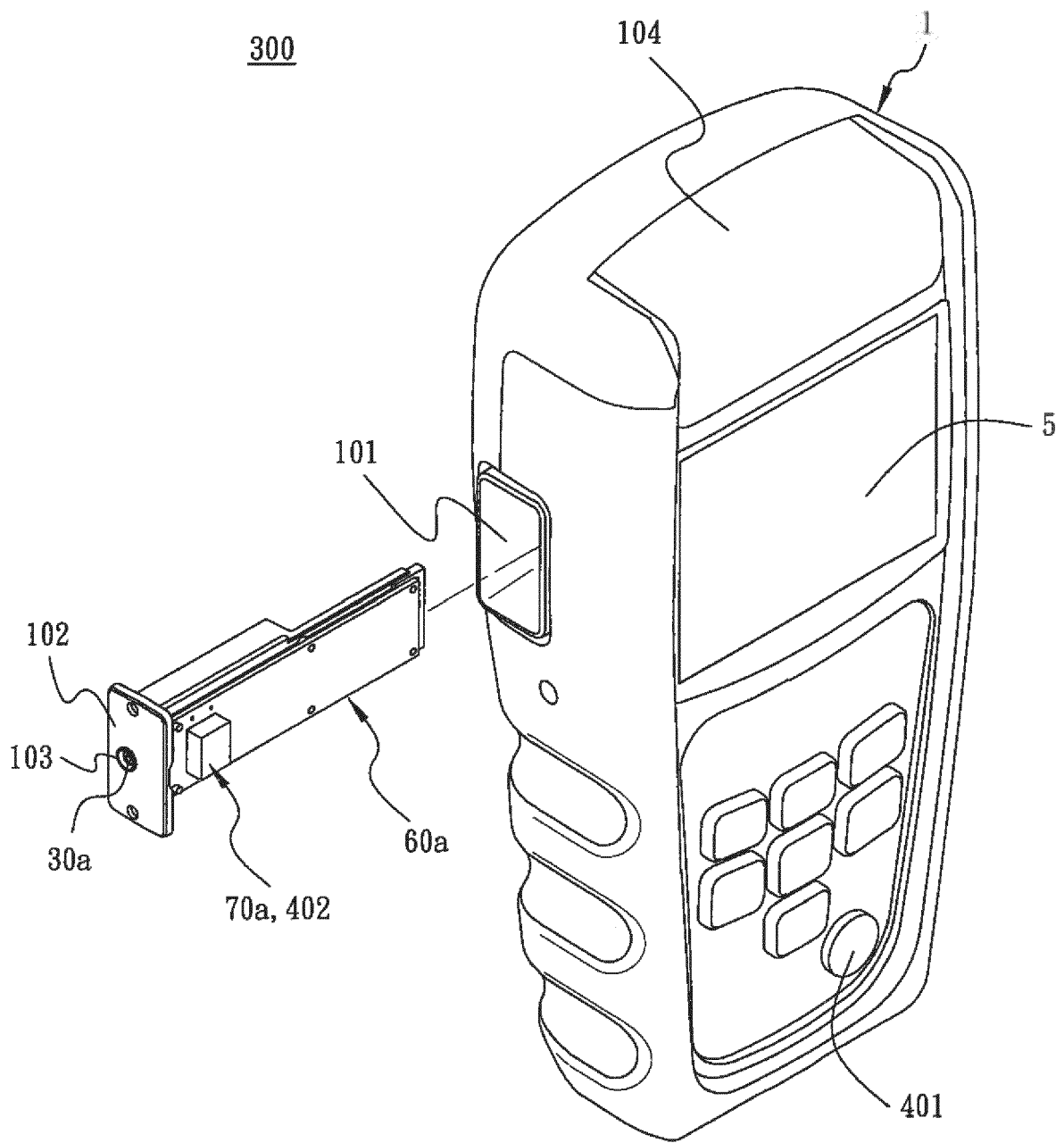


FIG. 8

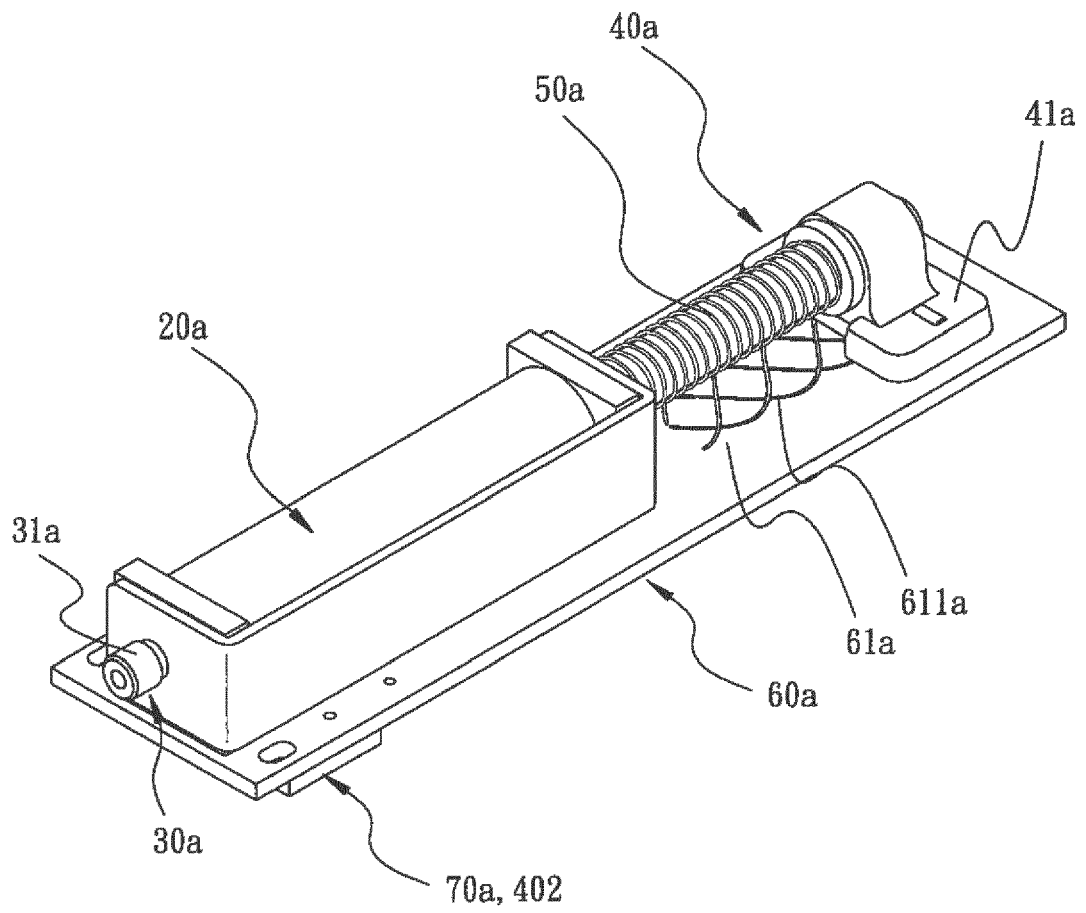


FIG. 9

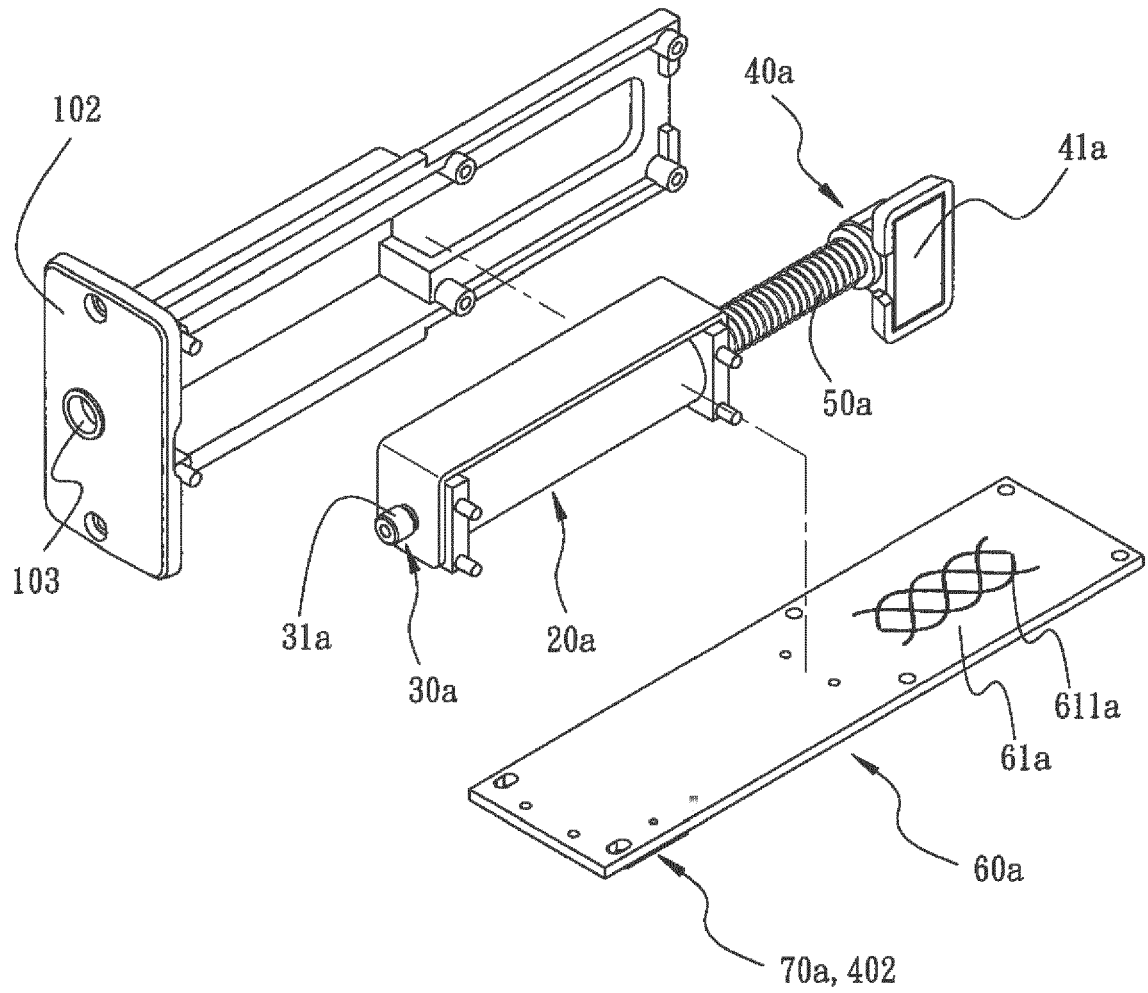


FIG. 10

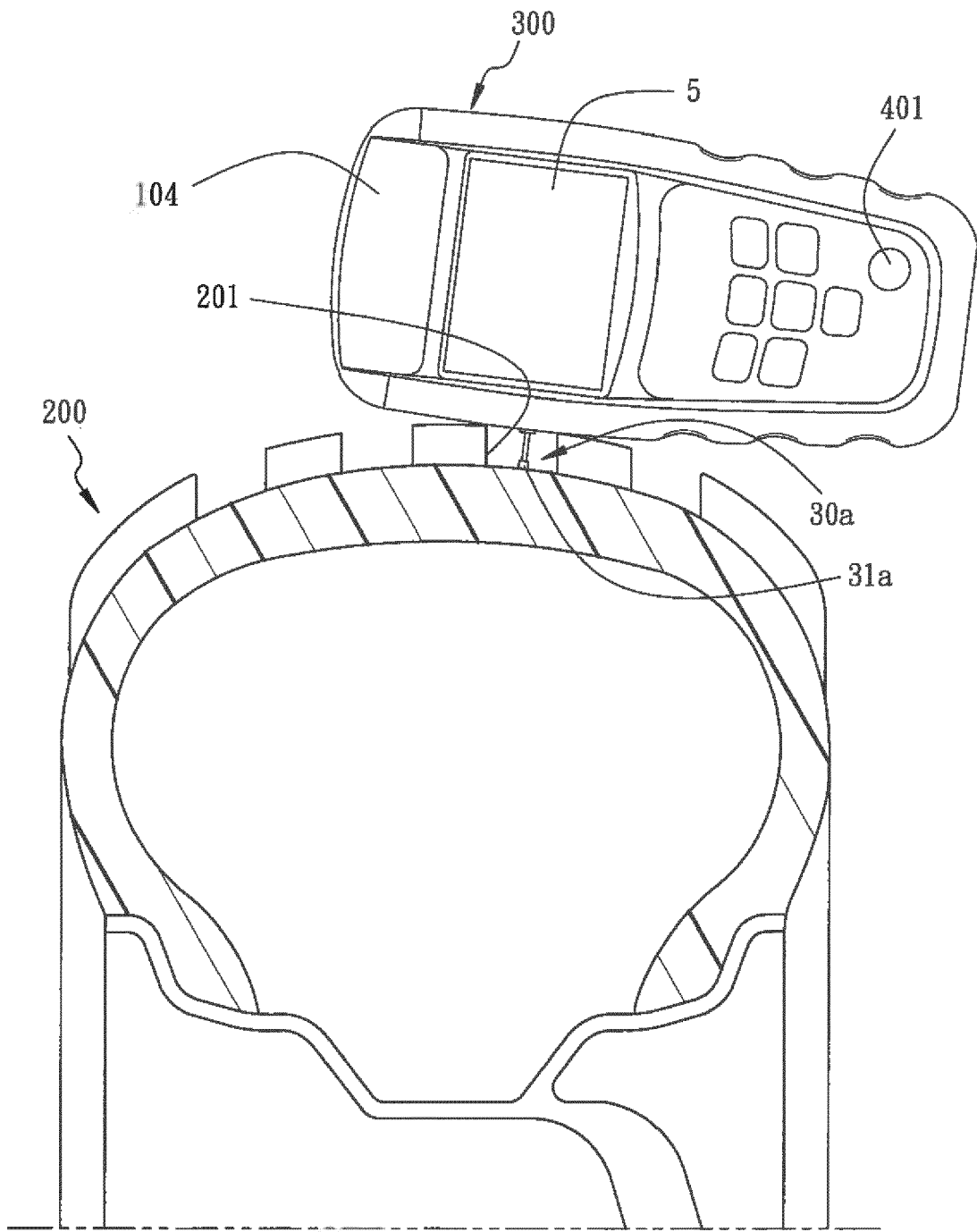


FIG. 11



EUROPEAN SEARCH REPORT

Application Number
EP 18 18 9130

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 2 460 115 A (PNEU LOGIC CORP LTD [GB]) 25 November 2009 (2009-11-25)	1,4-6	INV. G01B3/28
Y	* column 4, line 10; figure 11 * * column 4, line 16 - line 20 * * column 5, line 1 - line 24 *	4	
X	US 4 631 831 A (BACHER WILLIAM J [US] ET AL) 30 December 1986 (1986-12-30)	1-3,6	
Y	* column 4, line 20 - line 44; figures 2,3,10,12,13 * -----	4	
-----			TECHNICAL FIELDS SEARCHED (IPC)
			G01B
-The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 14 November 2018	Examiner Biedermann, Benjamin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)



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CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

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Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

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No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

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LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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see sheet B

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All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

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As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

40

Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

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None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

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1-6

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The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).



LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 18 18 9130

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The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

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1. claims: 1-6

Tire tread detector

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2. claims: 7-12

Tire pressure detector

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 18 18 9130

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

14-11-2018

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB 2460115	A	25-11-2009	NONE

US 4631831	A	30-12-1986	NONE

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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